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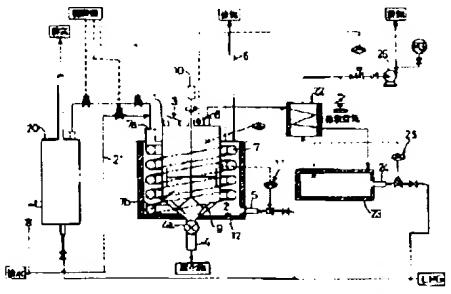
(54) **CARBONIZATION OF WASTE**

(57) Abstract:

PROBLEM TO BE SOLVED: To shorten treatment time, the reduction of energy, the reduction of the weight and volume of residues and the prevention of an explosion accident by executing dry distillation and carbonization of waste in the state of lowering the oxygen concn. in an atmosphere by supplying high-temp. steam, then supplying moisture and cooling the treated matter, thereby obtaining carbide.

SOLUTION: The dry distillation and carbonization stage is executed after the end of a fermentation stage. The dry distillation is executed by preferably raising the temp. in a vessel 1 to about 300°C and holding this for a prescribed time. Heating is executed by blowing the high-temp. steam heated with waste gas heat into the vessel 1. The carbonization to be executed after the dry distillation is executed by raising the tamp. in the vessel 1 preferably to about 700°C and holding this temp for a prescribed time while blowing the high-temp. steam formed by the supply of the steam by a boiler 20 and the superheating by a burner 5 into the vessel 1. The cooling stage is executed by putting out the burner 5 and injecting water from a water supply pipe 21 into the vessel 1 while agitating the treated matter after the carbonization. After the temp in the vessel 1 falls down to 100 to 150°C, the carbide is taken out



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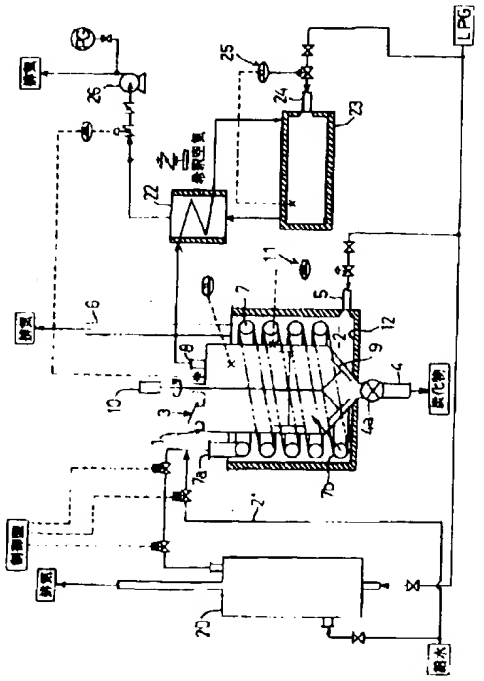
(54)【発明の名称】　廃棄物の炭化方法

(57)【要約】

【課題】　ダイオキシン類発生の抑制効果を維持しつつ、処理時間の短縮、エネルギーの削減、残渣の減量・減容および爆発事故防止が可能な廃棄物の炭化方法を提供する

【解決手段】　高温水蒸気を供給して雰囲気中の酸素濃度を低減した状態で、廃棄物の乾留・炭化を行う乾留炭化工程を有し、その後、水分を供給して処理物を冷却して炭化物を得る冷却工程を有する廃棄物の炭化方法



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【特許請求の範囲】

【請求項1】　高温水蒸気を供給して雰囲気中の酸素濃度を低減した状態で、廃棄物の乾留・炭化を行う乾留炭化工程を有し、その後、水分を供給して処理物を冷却して炭化物を得る冷却工程を有する廃棄物の炭化方法

【請求項2】　前記乾留炭化工程にて発生するガスを、前記乾留炭化工程で加える熱エネルギーの発生の燃料として使用する請求項1記載の廃棄物の炭化方法

【請求項3】　前記乾留炭化工程に先立って廃棄物の発酵を行う発酵工程を有する請求項1または2記載の廃棄物の炭化方法

【請求項4】　前記発酵工程が処理物温度40℃以上100℃未満で行われる請求項3記載の廃棄物の炭化方法

【請求項5】　前記乾留炭化工程のうち、乾留の槽内温度100℃以上400℃未満で行われ、炭化の槽内温度400℃以上800℃未満で行われる請求項1～4いずれか記載の廃棄物の炭化方法

【請求項6】　前記乾留炭化工程、または前記乾留炭化工程および前記発酵工程を撹拌しながら行う請求項3～5いずれか記載の廃棄物の炭化方法

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、生ゴミを含む都市ゴミ、産業廃棄物等の廃棄物の乾留・炭化を行う乾留炭化工程とその処理物の冷却工程とを有する廃棄物の炭化方法に関する

【0002】

【従来の技術】最近、廃棄物を焼却する際、猛毒のダイオキシン類が発生し大きな社会問題となっている。これを解決する一手段として、焼却工程を伴わない廃棄物の乾留・炭化による処理方法が取り上げられている。そして、このような炭化方法では、間接加熱方式により加熱を行っているが、廃棄物の乾留・炭化が酸素を完全に遮断できない状態で行われているのが通常である。

【0003】

【発明が解決しようとする課題】しかしながら、従来の焼却処理方法に比較して、炭化処理の方法は上記のような欠点があり、あまり採用されていない現状にある。つまり、①　処理に要する時間が長くエネルギー消費量が大きい、②　残渣（灰や炭化物）が多い、③　乾留ガス（可燃性ガス）が発生し爆発の危険性があるなどの欠点が指摘されている

【0004】上記①については、廃棄物には生ゴミ、廃プラスチック、紙ゴミ、繊維ゴミ、木ゴミ、汚泥等、選別されることなしにあらゆるものが含まれるが、特に水分の多い生ゴミ等は水分の蒸発に時間が掛かり、さらに表面が炭化すると表面の炭化物が断熱材となり中まで熱が伝わりにくいことそもあって炭化処理に長時間を要している。また、炭化処理の場合、雰囲気を遮断下での処理物に外部より熱を加える、いわゆる間接加熱方式であるため焼却処理のように廃棄物の発熱量を有効に利用出来ないことから燃費が高く、炭化処理方法の採用を大きく阻害している

【0005】上記②については、廃棄物を炭化処理した場合、可燃分を多くの炭化物が残渣として残り、炭化物の有効利用方法が見つからない現状において、埋め立て処分場等に持ち込み処分する訳にいかず、炭化処理方法の採用を阻害している

【0006】上記③については、廃棄物には多量の廃プラスチックが含まれており、炭化処理ガスさらに温度を上げると廃プラスチックが気化し、可燃性のガス体となり、取り扱いを間違えると爆発の危険があり、安全で誰にも扱えるような装置が実用化されていない。また、爆発の危険のある炭化温度は乾留ガスが爆発しない温度とされる400℃以下で運転する必要があり、炭化温度が400℃以上に上げられないことから処理に要する時間が長くなり、上記①の欠点を助長させている

【0007】従って、本発明の目的は、上記欠点に鑑み、ダイオキシン類発生の抑制効果を維持しつつ、処理時間の短縮、エネルギーの削減、残渣の減量・減容および爆発事故防止が可能な廃棄物の炭化方法を提供することにある

【0008】

【課題を解決するための手段】この目的を達成するための本発明の特徴構成は、高温水蒸気を供給して雰囲気中の酸素濃度を低減した状態で、廃棄物の乾留・炭化を行う乾留炭化工程を有し、その後、水分を供給して処理物を冷却して炭化物を得る冷却工程を有する点にある。ここで、乾留とは、被処理物が水分を含むために、乾燥も同時に生じる場合をも含む概念である

【0009】上記構成において、前記乾留炭化工程にて発生するガスを、前記乾留炭化工程で加える熱エネルギーの発生の燃料として使用することが、後述の作用効果より好ましい

【0010】また、前記乾留炭化工程に先立って廃棄物の発酵を行う発酵工程を有することが、後述の作用効果より好ましい

【0011】そして、前記発酵工程は処理物温度40℃以上100℃未満で行われることが、後述の作用効果より好ましい

【0012】また、前記乾留炭化工程のうち、乾留の槽内温度100℃以上400℃未満で行われ、炭化の槽内温度400℃以上800℃未満で行われることが、後述の作用効果より好ましい

【0013】なお、前記乾留炭化工程、または前記乾留炭化工程および前記発酵工程を撹拌しながら行うことが、後述の作用効果より好ましい

【0014】【作用効果】本発明の上記特徴構成によると、乾留炭化工程を高温水蒸気を供給して雰囲気中の酸

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濃度を低減した状態（好ましくは実質的に酸素不存在下で）で行うため、乾留ガスの爆発の危険性をなくすことができ、しかも高温水蒸気での直接加熱により加熱効率が良く、また高温水蒸気を用いることの乾燥効果が高く、更に水蒸気が炭化物とガス化反応を起こして、炭化物の大幅な減容・減量が可能となる。更に、水分を供給して処理物を冷却して炭化物を得る冷却工程を有するため、処理物の熱によりこの冷却時に水分の蒸発がおこり、その際の蒸発潜熱が大きいため、処理物の冷却効率が高く、蒸気の発生が爆発防止にも有効となる。また、例えば高温度の炭化物が顕熱を有する場合、含水している水分はこの保有熱によって自然乾燥、貯蔵、袋詰の等、取り扱い容易な炭化物となる。その結果、ダイオキシン類発生の抑制効果を維持しつつ、処理時間の短縮、エネルギーの削減、残渣の減量・減容、および爆発事故防止が可能な廃棄物の炭化方法を提供することができた。

【0015】前記乾留炭化工程にて発生するガスを、前記乾留炭化工程で加える熱エネルギーの発生の燃料として使用する場合、乾留炭化工程にて発生するガスは、高エネルギーのガスとなるが、これを水蒸気の発生の燃料や、水蒸気加熱の燃料として使用することにより、装置全体のエネルギー消費量をより削減することができる。

【0016】前記乾留炭化工程に先立って廃棄物の発酵を行う発酵工程を有する場合、発酵工程により、廃棄物中に含まれる生ゴミ、特に炭化し難い肉、魚、野菜等の生ゴミは適度な温度と時間において発酵し、組織が破壊され肉、魚、野菜等の組織内における内部水は脱水されて水分が抜けたようになり、後工程の乾燥、炭化が容易になる。その結果、炭化物の減容・減量がより促進される。なお、紙、繊維、木屑などを炭化する場合、発酵工程は不要になるが、その場合でも本発明の炭化方法は、上述のような顕著な効果を示す。

【0017】前記発酵工程が処理物温度40℃以上100℃未満で行われる場合、廃棄物中に含まれる生ゴミに対する前述の発酵作用が好適に生じるが、かかる観点から、より好ましくは70℃以上80℃未満で行われる。

【0018】前記乾留炭化工程のうち、乾留が槽内温度100℃以上400℃未満で行われ、炭化が槽内温度400℃以上800℃未満で行われる場合、乾留と炭化は本来は別々にという現象であり、廃棄物のような混合物では同時に生じる場合もあるが、両者を別々の上記温度にわけて行うことにより、前者では主に水分の蒸発と乾留ガスの発生を好適に行わせ、後者では主に炭化の促進と水性ガス反応を好適に行わせることができ、更に、発生ガスを個別に有効利用できる。なお、かかる観点から、乾留が200℃以上350℃未満で行われ、炭化が500℃以上750℃未満で行われるのが好ましい。

【0019】前記乾留炭化工程、又は前記乾留炭化工程および前記発酵工程を攪拌しながら行う場合、それぞれの工程において、熱的均一化やガス収支などが好適に行われるため、各工程における処理効率が良くなり、処理時間の短縮などにつながる。

【0020】

【発明の実施の形態】以下に本発明の実施の形態を図面に基づいて説明する。本実施形態では、廃棄物の発酵を行う発酵工程、高温水蒸気を供給して雰囲気中の酸素濃度を低減した状態で、廃棄物の乾留・炭化を行う乾留炭化工程を、攪拌しながらバッチ式にまとめて、1つの槽内で順次行った後、槽内に水分を供給して処理物を冷却して炭化物を得る冷却工程を行なう例を示す。

【0021】図1は本発明に係る設備の概略構成を示すものであり、本発明の炭化方法は、槽1中にて行われる。まず、設備の概略構成について説明する。槽1には廃棄物投入口13と炭化物排出口14が開閉可能に取り付けてあり、ガス燃焼室2とは、ダクト16が装備されている。槽1の外側には蒸気管7が設けられている。槽1は槽内に設けられた攪拌羽根9を駆動する駆動装置10が付随するか、槽1を回転させて攪拌する方式でもよい。また、槽1内の温度を制御する温度制御装置11が設けられている。また、ガス燃焼室2には耐火断熱材12が内張りされている。ボイラ20は水蒸気を発生させて供給口17aより供給を行う。蒸気は蒸気管7内で燃焼排ガス熱で加熱され高温水蒸気となり、蒸気吹き出し口17bより槽1内に放出される。槽1内のガスはガス排出口18から排出され、熱交換器22で予熱されたのち、脱臭炉23でバーナ24により燃焼脱臭され、排ガスとして放出される。その際、温度制御装置25により脱臭炉23内の温度調整を行い、また脱臭炉23から排出された排ガスは熱交換器22にて冷却されたのち、誘引排風機26により排出される。

【0022】発酵工程は、槽1の上部に設けられた廃棄物投入口13より廃棄物と発酵菌を投入し投入口13の蓋を閉めた後、槽内の攪拌羽根9により廃棄物と発酵菌を攪拌混合したのち、ガス燃焼室2に装備されたバーナ5により、処理物温度を約70～80℃に保ち、約1～3時間保持する。すると、廃棄物中の生ゴミは初期発酵によって、組織が破壊され組織内の内部水が脱水されて水はけがよくなりやすく減容する。なお、発酵工程は通常、酸素の存在下にて上記温度で行われるため、ボイラ20による水蒸気の供給は行われない。

【0023】乾留炭化工程は、この発酵工程終了後に行われるが、乾留とは水分の蒸発＋乾留ガスの発生を指す。＋炭化（とは炭化の促進＋水性ガス反応を指す）とを別々の温度に分けて行う例を示す。乾留は、槽内の温度を好ましくは約300℃にまで約0．5～1時間保持することによって行うか、排ガス熱で加熱された高温水蒸気を槽1に吹き込んで加熱を行なわれる。これにより、廃棄物中の廃プラスチック類はガス化し、木くず、紙くず、繊維くず等は炭化が始まり、生ゴミは乾燥する。発生した乾留ガス（水蒸気を多量に含む）は脱臭炉23内

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て可燃分が燃焼し、水蒸気を含む燃焼排ガスは熱交換器22で冷却されて大気中に放出される。

【0024】乾留炉において行われる炭化は、ボイラ20による水蒸気の供給をストップすることにより生成した高温蒸気を槽1内に吹き込むことにより、槽1内温度を好ましくは約700℃に昇温し、1.0.5～2時間保持することによって行われる。また、この槽1内廃棄物は全体が、ガスなどの可燃物を除き炭化し、この蒸気によるガス反応によって炭化物は大幅に減量、減容する。一方、ガス反応によって発生したガスは、脱臭炉23内で送られて燃焼し、その燃焼排ガスは熱交換器22で冷却されて大気中に放出される。その際、バーナ24への燃料供給は、ほぼゼロで十分になる。

【0025】冷却工程は、炭化工程終了後に行われ、バーナ24を消火し、炭化後の処理物を撹拌しながら槽1内に水供給管21からの水を噴射することにより、炭化物が100～150℃に温度が下がった後、取り出口12を開き、炭化物を大気中に取り出す。取り出口12を開く際、含有している水分は炭化物の保有熱によって自然乾燥し、短時間で貯蔵、製品化などを可能にする。なお、炭化物出口12の下方に水槽を設けて、その水槽内で処理物を冷却してもよい。

【0026】次に、以上のような本実施形態の効果について説明する。処理の1工程を3分割に炭化を容易にしたこと、炭化工程において安全に昇温が可能になったことなどによって、処理時間は既存の炭化装置に比較して約1／3に短縮した。また、工程ごとに温度の保持時間を任意とでき、処理時間を短縮できたこと、さらに反応によって可燃性ガスを発生させこれを燃料として使用することができて、燃費は既存の炭化装置に比較して約1／5に低減した。

【0027】〔別実施形態〕以下に別実施形態を説明する。

【0028】(1)先の実施形態では、図1に示すようにガス燃焼室と装置本体とを一体的に構成する装置を用いる例を示したが、図2に示すように、両者を別個に構成する装置を用いてもよい。その場合、図2に示すように、例えば槽1より乾留ガスをガス燃焼室に導入する乾留ガス導入管8aを取り付けて燃料の低減を図ってもよい。かかる装置によると、乾留時にガス反応によって発生したガスはガス燃焼室に送られ、槽1を加熱する熱源として用いられ、ガス燃焼室に装備されたバーナ5の燃料使用量を大幅に削減することになる。

【0029】また、上記装置では、炭化工程終了後、蒸気管7の給水をそのまま続け、ガス燃焼室に設けられたバーナ5を消火する。蒸気管7に給水されている水は蒸気から水に移行し、槽1内に噴射されることによって炭化物に冷却される。槽1内の温度が約100～150℃になったことを確認し、炭化物を取り出すことによって、大気中で発火することなしに安全に取り出すことができる。なおこの温度で取り出せば炭化物の保有熱によって大気中で自然乾燥し、すぐれた炭化物として取り扱い容易になる。また、槽1を冷却するための次の新しい廃棄物を速やかに槽1に投入することが可能である。

【0030】(2)先の実施形態では、乾留炭化工程で発生するガスを、水蒸気の発生の燃料として使用した例を示したが、ボイラに上記ガスを供給することによってボイラの燃料使用量を削減してもよい。なお、上記(1)の実施形態はガス燃焼室に上記ガスを供給することによって水蒸気の加熱のための燃料使用量を削減している形態に相当する。

【0031】(3)先の実施形態では、乾留炭化工程を2段に分けて行う例を示したが、上記のごとき乾留と炭化を、高温水蒸気を供給して雰囲気中の酸素濃度を低減した状態で、同時に行うようにしてもよい。その場合、操作温度500～750℃にて、被処理物の量や種類に応じて適当な時間で行われる。

【0032】(4)先の実施形態では、発酵、乾留、炭化、冷却の各工程を同一の槽内でバッチ形式で行う例を示したが、当然、各工程を別々の槽内で行ってもよく、各槽を連続的に接続して連続形式で行ってもよい。連続式処理を行う場合、搬送機能を備える回転炉や部分抜出し機構などを有する撹拌ガセが用いられ、各部間のシール方法としては、気密を維持しつつ被処理物の搬送が可能な、回転式ドアーなどが採用できる。

【0033】(5)先の実施形態では、蒸気加熱管が槽の外周に配置される装置を用いる例を示したが、図3に示すように、蒸気加熱管を脱臭炉に配置するものであってもよい。その場合、脱臭炉23で生じた燃焼排ガスにより、蒸気加熱管7内で加熱された高温水蒸気は、槽1に設けられた蒸気吹き出し17bより槽1内に放出される。なお、図3に示す装置では、脱臭炉23での燃焼排ガスは、槽1の間接加熱の熱源としても利用される。

【図面の簡単な説明】

【図1】炭化方法に用いられる設備の一例を示す概略構成図

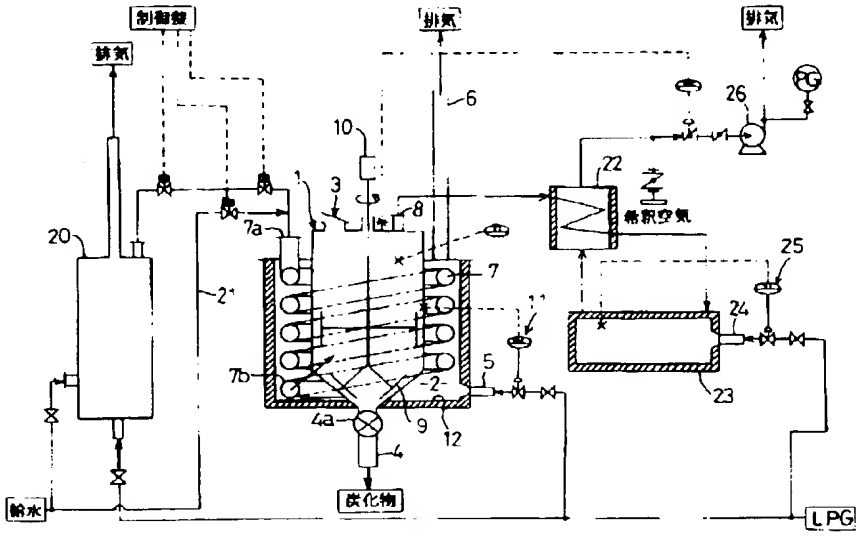
【図2】炭化方法に用いられる設備の一例の要部を示す概略構成図（蒸気加熱管槽外周配置の例）

【図3】炭化方法に用いられる設備の一例の要部を示す概略構成図（蒸気加熱管脱臭炉配置の例）

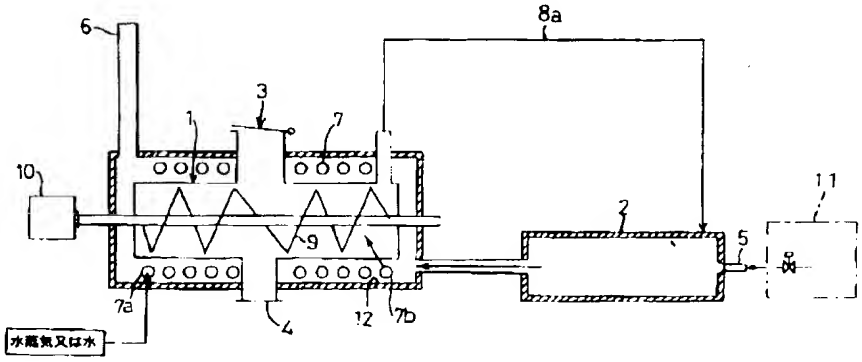
【符号の説明】

1　槽
7　蒸気管
20　ボイラ

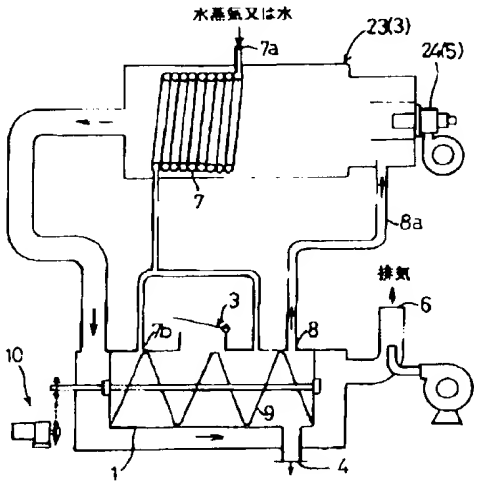
【図1】


制御盤
排気
排気
排気
6
10
26
22
1
3
8
7a
希釈空気
20
7
25
2'
11
24
7b
5
2
23
4a
9
12
4
炭化物
給水
LPG

【図2】


6
8a
3
1
7
10
11
9
2
5
7a
12
7b
4
水蒸気又は水

【図3】



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention -- NaCl and MgCl2 etc. -- the plastics mixture containing the plastics containing the chlorine discharged from the home containing an inorganic chlorine compound, such as a common contaminant and a vinyl chloride, -- [for example,] In processing of trash, such as car shredder dust containing the plastics containing chlorine or a mineral constituent.Harmful organochlorine compounds, such as dioxin, are not generated and it is related with the manufacture approach of a dechlorination fuel and equipment which use effectively the dechlorination approach list processing product of the trash which can control the yield of trash, such as gasification residue and combustion ashes, further.
[0002]
[Description of the Prior Art] In recent years, the trash containing the plastics mixture and the mineral constituent containing the plastics containing chlorine, such as a polyvinyl chloride and a polyvinylidene chloride, is discharged so much, and the increment also of the amount of abandonment is being enhanced. The present condition is that the greater part of such trash carries out incineration disposal as it is, or the landfill is carried out.
[0003] When incineration disposal is carried out, harmful matter generated in the case of incineration, such as a hydrogen chloride and dioxin, may be emitted to atmospheric air as they are. Moreover, when a landfill is carried out, since the active principle in trash is not used, it becomes loss of a resource. Then, collecting the active principles in it is proposed by pyrolyzing these trash.
[0004] However, chlorine compounds, such as a hydrogen chloride and chlorine gas, are generated in large quantities by the pyrolysis, gasification, or combustion of the plastics containing the chlorine in trash, and this not only causes a serious public nuisance, but causes the corrosion of a pyrolysis furnace, a gasifier, or a combustion furnace. Then, in order to remove a chlorine compound by pretreating these trash, the approach the indirect heating at a heat carrier, a heater, etc. performed a pyrolysis in a decomposition tub was proposed.
[0005] By this approach, since homogeneity heating of the solid-state inside a cracking unit is difficult, the parts softened and fused [especially] by local heating with thermoplastics weld, and it becomes massive, and is left in the plastics which the non-decomposed hydrogen chloride fused, and this hydrogen chloride cannot be removed completely. Moreover, as alkali metal compounds, such as calcium, Na, and K, were added in these trash and a pyrolysis and by making it gasify or burn showed to following "** 1", the approach of removing as chlorine compounds (CaCl2, NaCl, KCl, etc.) with alkali metal was proposed.
[0006]
[Formula 1]
calcium(OH)2+ 2HCl -> CaCl2+ 2H2O -- (1)
CaCO3 + 2HCl -> CaCl2+ H2O+CO2 -- (2)
NaOH + HCl -> NaCl + H2O -- (3)

h g cg b eb cg e e

KOH + HCl -> KCl + H2O -- (4)
[0007] However, hydrogen chloride HCl generated from trash In order to make the whole quantity react with alkaline metals and to decompose as a chlorine compound, in consideration of conversion, the alkaline metals more than about 4 time equivalence were added by the former. Consequently, in order to add superfluous alkaline metals, a lot of residue was discharged and it was a problem.
[0008] Moreover, when processing again the residue containing the chlorine compound metallurgy group which carried out the byproduction with a melting furnace etc. and collecting metals after pretreating the trash which contains metals, such as car shredder dust, by this approach, these chlorine compounds are in a melting condition at elevated temperature about 750 degrees C or more, and there is also a problem that this disperses as Myst and causes corrosion in contact with a metal. By the approach of burning the trash which contains a lot of chlorine especially as it is, and adding an alkali metal compound to this, the amount of the chlorine compound which carries out a byproduction also increases, and the problem of the corrosion by melt also becomes large.
[0009] Furthermore, since the heavy metal of a minute amount is contained as a plasticizer, a stabilizer, or a coating in plastics, there is a problem in carrying out disposal of the part for such combustion residue as it is.
[0010]
[Means for Solving the Problem] Invention of the [claim 1] of this invention which solves the aforementioned technical problem is characterized by to consist of a rinsing process which rinses this dechlorination solid made detailed the separation process which separates the dechlorination process which decholorinates while pyrolyzing the trash containing chlorine, and a dechlorination solid and cracked gas, and a detailed chemically-modified [which grinds and makes detailed the separated dechlorination solid] degree, and removes mineral salt.
[0011] Invention of [claim 2] is characterized by having the grinding process which grinds and carries out grain refining of the trash which contains chlorine in the preceding paragraph of a dechlorination process, and is used as grain-refining trash in claim 1.
[0012] Invention of [claim 3] is characterized by being about the desiccation process which dries the dechlorination solid after rinsing after the above-mentioned rinsing process in claim 1 or 2.
[0013] In claim 1 thru/or 3, in the above-mentioned dechlorination process, it is dechlorinated invention of [claim 4] introducing a steam, and is characterized by preventing inorganic chlorination of chlorine.
[0014] Invention of [claim 5] is characterized by processing under reduced pressure in the above-mentioned dechlorination process in claim 1 thru/or 4.
[0015] Invention of [claim 6] is characterized by having the preheating process which heats beforehand the trash ground between the above-mentioned grinding process and the dechlorination process in claim 1 thru/or 5.
[0016] Invention of [claim 7] is characterized by having the elevated-temperature combustion process which burns the cracked gas separated at the above-mentioned separation process at a secondary combustion furnace, and the offgas treatment process which removes the chlorine in exhaust gas in claim 1 thru/or 6.
[0017] Invention of [claim 8] is characterized by having the heat exchange process which carries out heat exchange of the exhaust heat of gas between the above-mentioned elevated-temperature combustion process and an offgas treatment process in claim 1 thru/or 7.
[0018] In claim 8, the above-mentioned heat exchange process introduces air, and invention of [claim 9] considers as heating air, and is characterized by using this heating air for heating of the above-mentioned dechlorination process.
[0019] Invention of [claim 10] is characterized by having the steamy generating process that the above-mentioned heat exchange process generates a steam using exhaust heat, and using the generated steam for heating of the above-mentioned dechlorination process in claim 8.
[0020] In claim 8, invention of [claim 11] is characterized by using a heat process as a heat source of a desiccation process further beforehand while it has the steamy generating process that the above-mentioned heat exchange process generates a steam using exhaust heat and uses the generated steam for

the above-mentioned dechlorination process.
[0021] It is characterized by invention of [claim 12] performing a pyrolysis process by direct heat-treatment or indirect heating processing in claim 1.
[0022] It is characterized by invention of [claim 13] performing decomposition temperature of a pyrolysis process at 300-450 degrees C in claim 1.
[0023] Invention of [claim 14] is characterized by grinding grinding of the above-mentioned grinding process to 20mm or less in claim 1.
[0024] Invention of [claim 15] is characterized by grinding grinding of a detailed chemically-modified [above-mentioned] degree to 10mm or less in claim 1.
[0025] Invention of [claim 16] is characterized by making preheat temperature of the above-mentioned preheating process into 200-300 degrees C in claim 6.
[0026] In claim 7, invention of [claim 17] makes combustion temperature of an elevated-temperature combustion process 750-1000 degrees C, and is characterized by burning at least 2 seconds or more.
[0027] In claim 12, invention of [claim 18] is characterized by circulating the gas by which an oxygen density does not contain low gas or oxygen, when a dechlorination process is direct heat-treatment.
[0028] Invention of the manufacture approach of the dechlorination fuel of [claim 19] drains off water from the slurry object rinsed at the rinsing process of claim 1, and is characterized by obtaining a slurry-like dechlorination fuel.
[0029] It dries at the desiccation process of claim 3, and invention of [claim 20] is characterized by obtaining a dechlorination solidification fuel.
[0030] Invention of the manufacturing installation of the dechlorination fuel of [claim 21] The grinder which grinds the trash containing chlorine, and the dechlorination furnace which decholorinates while heating and pyrolyzing this grain-refining trash, It consists of the eliminator which separates a dechlorination solid and cracked gas, a grinder which grinds and makes detailed the separated dechlorination solid, and a rinse tank from which the this ground dechlorination solid is rinsed and mineral salt is removed, and is characterized by obtaining a dechlorination fuel from the trash containing chlorine.
[0031] Invention of the manufacturing installation of the dechlorination fuel of [claim 22] consists of the eliminator which separates the dechlorination furnace which decholorinates while pyrolyzing a refuse-derived fuel (RDF), and a dechlorination solid and cracked gas, a grinder which makes detailed the separated dechlorination solid, and a rinse tank from which the this ground dechlorination solid is rinsed and mineral salt is removed, and is characterized by obtaining a dechlorination fuel from the refuse-derived fuel (RDF) containing chlorine.
[0032] In claim 21 or 22, invention of [claim 23] has the desiccation process which dries the dechlorination solid after rinsing after the above-mentioned rinsing process, and is characterized by obtaining a dechlorination solid fuel from the trash containing chlorine.
[0033] Invention of [claim 24] is characterized by forming a steam installation means in a dechlorination furnace in claim 21 or 22.
[0034] Invention of [claim 25] is characterized by establishing a reduced pressure means to decompress the inside of a dechlorination furnace in claim 21 or 22.
[0035] Invention of [claim 26] is characterized by pivotable or enabling stirring of the interior of a furnace of the dechlorination furnace itself in claim 21 or 22.
[0036] This invention explains the outline of the main specific matters of aforementioned The means for solving a technical problem below.
[0037] 1) Establish a detailed process after a dechlorination process. At the dechlorination process by the pyrolysis, by making into a hydrogen chloride more than abbreviation 80wt% of the chlorinity contained in trash, a dechlorination and in order to dissociate, in the solid after dechlorination, the chlorine not more than abbreviation 20wt% of the chlorine contained at the beginning remains. This residual chlorine reacts with the alkaline metals contained in trash (following reaction-formula [which is shown in "** 2"] (1) - (4)), and generates a chloride. Since the melting point is about 700-850 degrees C, this chloride is fused at gasification or a combustion process, serves as Myst, it is said-**(ed) in gas,

is solidified in the low-temperature section of a back process, and becomes causes, such as corrosion.
[0038]
[Formula 2]
calcium(OH)2+ 2HCl -> CaCl2+ 2H2O -- (1)
CaCO3 + 2HCl -> CaCl2+ H2O+CO2 -- (2)
NaOH + HCl -> NaCl + H2O -- (3)
KOH + HCl -> KCl + H2O -- (4)
[0039] Then, the solid separated after the dechlorination process is rinsed and it was made to dissolve and separate a chloride meltable in water in this invention. Since the chloride is contained also inside the solid at this time, after establishing a detailed process, carrying out grinding processing of the solid and making it the diameter of detailed, the cleaning effect has been heightened by carrying out rinsing processing. It is better for 1-5mm or less to cost 10mm or less preferably as a grinding particle size made detailed here.
[0040] 2) Perform a pyrolysis in a steam ambient atmosphere in a dechlorination process. In the case of a steam ambient atmosphere, in pyrolysis dechlorination, the reverse reaction of said reaction-formula (1) - (4) occurs. So, in this invention, the gas containing a steam is used as gas for a purge supplied to the dechlorination furnace into which trash was put. At this time, the higher one of steam concentration is desirable. In addition, a steam can be supplied by using the exhaust heat in the art of this invention effectively.
[0041] 3) Carry out reduced pressure processing of the interior of a furnace in a dechlorination process. HCl decomposed in pyrolysis dechlorination Gas reacts with the metals contained in trash, and carries out the byproduction of the chlorine compound. Then, it is HCl by carrying out reduced pressure processing of the inside of the dechlorination furnace into which trash was put, in order to prevent this in this invention. The diffusion rate to the outside of the system of gas is made to increase.
[0042] 4) Prepare an agitator style in the interior of a furnace in a dechlorination process. In order to control that the nodule of the waste plastic softened and fused with heating generates as a internal structure of a pyrolysis dechlorination furnace, in this invention, an agitator style is prepared in the interior of a furnace. Moreover, HCl generated in the pyrolysis according to this device Gas can be efficiently diffused and deaerated from the interior of a layer of trash.
[0043] 5) Establish the device in which the furnace itself is rotated, in a dechlorination process. By rotating the dechlorination furnace which holds trash, it has the effectiveness of making it exfoliating by the particle of the trash which moves the wall surface affix of the high-boiling point component generated by the pyrolysis.
[0044]
[Embodiment of the Invention] Hereafter, although the gestalt of operation of this invention is explained, this invention is not limited to this.
[0045] With the gestalt of [gestalt of the 1st operation] book operation, after carrying out the pyrolysis dechlorination of the trash containing chlorine, while obtaining a dechlorination fuel by dissolving the mineral salt ghost which once rinsed and carried out the byproduction in water, and dissociating, it is made to decholorinate trash. Moreover, the fuel decholorinated by this processing can be obtained. Furthermore, without being accompanied by the failure by the chloride as a fuel of that blasting-fumes-izing or a combustion process, combustion processing of this obtained dechlorination fuel can be carried out, and it enables clean processing without generating of the harmful matter in that case, for example, dioxin.
[0046] Drawing 1 is the outline of equipment of decholorinating the trash concerning the gestalt of the 1st operation. Moreover, this equipment is also the outline of the manufacturing installation of a dechlorination fuel. The grinder 12 which carries out grain refining of the trash 11 containing chlorine to below predetermined size (for example, 20mm or less) as shown in drawing 1 , The preheater 14 which heats the ground trash 13 beforehand, and the dechlorination furnace 17 which decholorinates by heating the trash 15 by which the preheating was carried out, and by which grain refining was carried out in the condition that the steam concentration introduced from the steam installation means 16 is high, The

h g cg b eb cg e e

eliminator 21 which divides the decomposition product 18 by which the pyrolysis was carried out at the above-mentioned dechlorination furnace into exhaust gas 19 and the dechlorinated solid 20, It consists of a grinder 22 which carries out pulverization (5mm or less) of the separated dechlorination solid 20 to below predetermined size, and a rinse tank 24 from which the dechlorination solid 23 made detailed is rinsed, and mineral salt is removed, and trash 11 is decholorinated. Moreover, the above-mentioned rinse tank 24 removes the excessive moisture of the slurry object after rinsing as wastewater 25, and the slurry-like fuel 26 which is a dechlorination fuel is obtained.

[0047] In the HCl absorption tower which full decomposition of the aromatic series chlorine compound in gas etc. is carried out because the exhaust gas 19 separated with the above-mentioned eliminator 21 burns at an elevated temperature at the secondary combustion furnace 27, combustion gas 28 is cooled after that at an elevated temperature, and is offgas treatment equipment 29 Chlorine gas is removed, it is discharged outside as exhaust gas 30, and, on the other hand, the wastewater 31 which absorbed chlorine gas is processed with the waste-water-treatment facility 32 with the wastewater from the above-mentioned rinse tank 24.

[0048] Here, in order to promote dechlorination, it is not necessary to carry out melting of the above-mentioned preheater 14, and it is not necessary to form it especially depending on the contents of trash 11. Moreover, you may make it form a preheating means in the dechlorination furnace 17 at one. Namely, what is necessary is to make the inlet-port part of the dechlorination furnace 17 into the preheating section, and just to lengthen the need die length of the dechlorination furnace 17, in supplying the next dechlorination furnace 17, without passing through a preheater 14. What is necessary is just to make preheat temperature of the above-mentioned preheater 14 into 250-degree-C order preferably that what is necessary is just to consider as about 200-300 degrees C.

[0049] Here, the following examples are given as trash 11 containing chlorine.

** NaCl and MgCl2 etc. -- contaminant discharged from the home which the plastics containing an inorganic chlorine compound or chlorine mixed.

** Plastics mixture containing the plastics containing chlorine, such as a vinyl chloride.

** The so-called car shredder dust which uses plastics after removing the metals of an automobile as a principal component (it is called "CSD" below Car Shredder Dust :.).

[0050] the inside of the common contaminant discharged from a home -- chlorine -- about 1 -- about -3wt% -- it is contained. moreover -- the inside of the plastic waste discharged from the home currently collected separately in some areas -- chlorine -- about 2 -- about -5wt% -- it is contained. the example of a component of CSD is as follows, and a polyvinyl chloride (PVC) uses it as an electric wire for instrumentation -- having -- **** -- the inside of CSD -- as chlorine -- about 0.5 to 5 wt% -- it is contained.

[0051]

[Table 1]

カーシュレッダーダストＣＳＤの成分例

プラスチック	51.8wt%
ゴム類	6.8
金属類	7.1
ガラス	7.3
木質類	5.2
その他（砂，無機物）	21.8

[0052]

[Table 2]

h g cg b eb cg e e

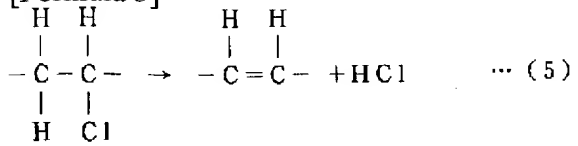
ＣＳＤ中のプラスチック類の内訳例

ポリプロピレン	21.6wt%
ＡＢＳ樹脂	21.4
ポリウレタン	15.9
ポリスチレン	12.1
ＰＶＣ	11.1
ポリエチレン	9.0
アクリル樹脂	3.1
ユリア樹脂	2.0
ポリ塩化ビニリデン	1.2
その他	2.6

[0053] Although grain refining of the above-mentioned trash 11 is carried out with the grinder 12, in using for example, a different direction rotating type 2 shaft screw etc., stirring may be 30-20mm or less as a dechlorination furnace 17 so that easily. Moreover, the smaller one of grinding particle size is desirable, if it is about 5mm, there will be no large burden in grinding power, and it is desirable. In addition, what is necessary is not to be referred to as 20mm or less, for example, just to be about 100mm as a dechlorination furnace 17, in using dechlorination furnaces, such as rotary kiln.
[0054] Although the grain-refining trash by which the preheating was carried out [above-mentioned] is pyrolyzed at the above-mentioned dechlorination furnace 16, as for pyrolysis conditions, it is desirable to consider as 300-450 degrees C. When it exceeds 450 degrees C, it is because the own decomposition of plastics advances and it is not desirable other than a dechlorination reaction, and on the other hand, at less than 300 degrees C, this has bad dechlorination efficiency and is both because it is not desirable. Although especially the heating approach of the above-mentioned dechlorination furnace 17 is not limited, it can hold an indirect heating method etc., for example other than a direct heating method. As for the gas to introduce, in the case of a direct heating method, it is desirable from the point of ignition prevention to circulate the gas by which an oxygen density (amount of O2) does not contain low gas or oxygen. However, it is not this limitation when heating directly under nitrogen-gas-atmosphere mind. In addition, the quantity of gas flow of a direct heating method is large, and since the amount of the occurring exhaust gas increases, it is more desirable [the indirect heating approach] from the point of miniaturization of equipment.
[0055] Moreover, HCl decomposed in pyrolysis dechlorination Gas is HCl by carrying out reduced pressure processing of the inside of the above-mentioned dechlorination furnace, in order to prevent reacting with the metals contained in trash and carrying out the byproduction of the chlorine compound. The diffusion rate to the outside of the system of gas is made to increase. As conditions for reduced pressure, the degree of vacuum of 0.1kg/cm2 or less is desirable.
[0056] Next, the weight percentage reduction in the pyrolysis of various plastics is shown in drawing 2 (the Mitsubishi Heavy Industries technical report, 10 (5) P787 (1973) reference). Generally, thermoplastics is softened and fused at about 120-230 degrees C, and is pyrolyzed at the elevated temperature after it. Moreover, heat-curing resin is pyrolyzed as it is with heating, without softening and fusing. There are a polyvinyl chloride (PVC) and a polyvinylidene chloride as plastics which contains chlorine among trash 11. If these chlorine content plastics is desorbed from a great portion of chlorine as a hydrogen chloride in an about 170 degrees C - 350 degrees C field and becomes an elevated temperature after that, the pyrolysis of other components will advance. The model of chlorine desorption is shown in the reaction formula (5) shown in following "** 3."

h g cg b eb cg e e

[0057]
[Formula 3]



[0058] It is PVC (polyvinyl chloride) deHCl to drawing 3 . A rate is shown. It is deHCl about 100% above this drawing 3 to 300 degrees C. Although carried out, the prolonged residence time for dozens of minutes is required. As mentioned above, plastics mixture starts a pyrolysis rapidly from about about 250 degrees C, and most disassembles it by about 500 degrees C.
[0059] Then, the pyrolysis rate of this invention of the hydrocarbon in plastics was as much as possible slow in the trash 13 which ground first and carried out grain refining, the pyrolysis rate of Chlorine Cl carried out decomposition processing only of the part for the chlorine in trash in the quick temperature field (about 260-360 degrees C), and chlorine is disassembled and separated at the rate of a high dechlorination beyond 80-90wt% of an initial chlorine content. In this case, although with an initial chlorine content [about 20 wt(s)% of] chlorine is contained in the residual solid-state which makes a hydrocarbon component a subject, this chlorine reacts with the alkali compound contained from the beginning in trash (above (1) refer to the reaction of - (4)), a chlorine compound is generated, and Chlorine Cl is fixed. In the above-mentioned rinse tank 24, it dissolves in water easily and the chloride generated at this time is separated with a solid-state.
[0060] In order to raise heat exchange engine performance of 15, such as ground plastics, as structure of the dechlorination furnace 17 of a pyrolysis, it is desirable to use what established the device which agitates and mixes mixture in the pyrolysis furnace 17. Thus, since it will be in the condition of always grinding what adheres to a wall surface by establishing stirring and a mixing mechanism in the above-mentioned dechlorination furnace 17, it can prevent also caulking to a wall surface to coincidence.
[0061] Moreover, when the container itself rotates like for example, a rotary-kiln mold as a dechlorination furnace 17, what has churning / mixing capacity may be used. Thus, when rotating trash for the whole dechlorination furnace, the same effectiveness as the above can be acquired.
[0062] Furthermore, it is also possible to circulate a heating medium in an outer case by dual structure, and to perform pyrolysis processing by indirect heating as structure of the dechlorination furnace 17.
[0063] The decomposition product 18 by which decomposition processing was carried out at the dechlorination furnace 17 is moved to an eliminator 21 with a melting condition, and is divided into exhaust gas 19 and the dechlorination solid 20 here. The exhaust gas 19 separated from the above-mentioned eliminator 21 carries out the perfect combustion of the gas containing the hydrogen chloride which burned at the secondary combustion furnace 27 and was generated by the pyrolysis. 750-1000 degrees C of combustion conditions of this secondary combustion furnace 27 are preferably made into 800-900 degrees C. This is because the decomposition product in gas re-condenses, or soot is generated, there is a problem from the point of the endurance of a furnace further and it is not desirable, even if disassembly of a hydrocarbon does not begin at less than 750 degrees C but it makes it decompose preferably exceeding 1000 degrees C on the other hand. Moreover, by considering as about 2 seconds at 850 degrees C, burn time can carry out full decomposition of the dioxin in exhaust gas, and is desirable.
[0064] The dechlorination solid 20 separated from the eliminator 21 is ground by the grinder 22. It is better for 1-5mm or less to cost 10mm or less preferably as a grinding particle size which makes detailed and is made detailed in order that this grinding may remove efficiently the chlorides (CaCl2, CaCl2, NaCl, KCl, etc.) contained inside the solid 20. In addition, since it becomes the shape of so-called sludge and efficient stirring becomes impossible when referred to as 1mm or less, it is not desirable.
[0065] By the above approach, both, in order that [which can perform demineralization processing of trash 11] a chloride may not carry out little deer survival into residue, pollution-free-ization of generating gas and residue becomes easy. Moreover, since the obtained slurry-like fuel 26 is dechlorinated in the occurring gas even when burning it with the coal fuel (CWM (Coal WaterMiture):

high concentration coal water slurry (for example, coal: 70%, water:30%)) which could handle in the condition as it is using migration means, such as a pump, for example, was suspended in water, harmful matter, such as dioxin, does not exist but serves as clean exhaust gas.
[0066] With the gestalt of [gestalt of the 2nd operation] book operation, after carrying out the pyrolysis dechlorination of the trash containing chlorine like the gestalt of the 1st operation, what was made to dissolve the mineral salt ghost which once rinsed and carried out the byproduction in water, and was separated is further dried with a drying furnace. Moreover, the solid fuel by which the gestalt which differs from a slurry-like fuel by desiccation was dechlorinated is obtained. Furthermore, in the gestalt of this operation, a deployment is aimed at for exhaust heat of the gas discharged from a secondary combustion furnace at a dechlorination process.
[0067] Drawing 4 is the outline of the manufacturing installation of the dechlorination fuel concerning the gestalt of the 2nd operation. The grinder 12 which carries out grain refining of the trash 11 containing chlorine to below predetermined size (for example, 20mm or less) as shown in drawing 4 , The preheater 14 which heats the ground trash 13 beforehand, and the dechlorination furnace 17 which decholorinates by heating the trash 15 by which the preheating was carried out, and by which grain refining was carried out in the condition that the steam concentration introduced from the steam installation means 16 is high, The eliminator 21 which divides the decomposition product 18 by which the pyrolysis was carried out at the above-mentioned dechlorination furnace into exhaust gas 19 and the dechlorinated solid 20, It consists of the grinder 22 which carries out pulverization (for example, 5mm or less) of the separated dechlorination solid 20 to below predetermined size, a rinse tank 24 from which the dechlorination solid 23 made detailed is rinsed, and mineral salt is removed, and a drying furnace 41 which dries the solid content after rinsing. The solid content dried with this drying furnace 41 can be used as a dechlorination solid fuel 42.
[0068] Moreover, with the gestalt of this operation, a heat exchanger 43 is formed between the secondary combustion furnace 27 and offgas treatment equipment 29, heat of combustion is collected, and the steam is generated with the steam generator 44 which has a water supply means. He introduces the steam 16 obtained here in the above-mentioned dechlorination furnace 17, and is trying to control generating of a chloride.
[0069] Moreover, with the gestalt of this operation, the heating gas 45 introduced separately is used as a heat source for heating of the dechlorination furnace 17. The gas after heating at this dechlorination furnace 17 is supplied via Rhine 46 and 47 as the heat source of a preheater 14, and a heat source of a drying furnace 41. In addition, offgas treatment of the exhaust gas 48 in a drying furnace 41 is carried out separately.
[0070] Both, in order that [which can perform dechlorination of trash 11 by the above approach] a chloride may not carry out little deer survival into residue, pollution-free-ization of generating gas and residue becomes easy. Moreover, the dechlorination solid fuel 42 is led to processes, such as the next gasification and oil-izing, and the organic substance (hydrocarbon) is oil--ization[gasification or]-processed. On the other hand, the gas which generates this since it is dechlorinated in burning as a fuel is harmless, and in order that a chloride may not carry out little deer survival into residue, pollution-free-ization of residue becomes easy. Moreover, by installation of a heat exchanger 43, while being able to use exhaust heat effectively, a steam is generated with the obtained heat, this steam can be used at the dechlorination furnace 17, and a deployment of heat is attained.
[0071] With the gestalt of [gestalt of the 3rd operation] book operation, like the gestalt of the 2nd operation, after carrying out the pyrolysis dechlorination of the trash containing chlorine, further what was made to dissolve the mineral salt ghost which once rinsed and carried out the byproduction in water, and was separated by making it dry with a drying furnace Although the dechlorinated solid fuel is obtained, the gestalten of use of exhaust heat of the gas discharged from a secondary combustion furnace differ.
[0072] Drawing 5 is the outline of the manufacturing installation of the dechlorination fuel concerning the gestalt of the 3rd operation. The grinder 12 which carries out grain refining of the trash 11 containing chlorine to below predetermined size (for example, 20mm or less) as shown in drawing 5 ,

The preheater 14 which heats the ground trash 13 beforehand, and the dechlorination furnace 17 which decholorinates by heating the trash 15 by which the preheating was carried out, and by which grain refining was carried out in the condition that the steam concentration introduced from the steam installation means 16 is high, The eliminator 21 which divides the decomposition product 18 by which the pyrolysis was carried out at the above-mentioned dechlorination furnace into exhaust gas 19 and the dechlorinated solid 20, The grinder 22 which carries out pulverization (for example, 5mm or less) of the separated dechlorination solid 20 to below predetermined size, It consists of a rinse tank 24 from which the dechlorination solid 23 made detailed is rinsed, and mineral salt is removed, and a drying furnace 41 which dries the solid content after rinsing, and the solid content dried with the drying furnace 41 is obtained as a dechlorination fuel 42.

[0073] Moreover, with the gestalt of this operation, the heat exchanger 51 was formed between the secondary combustion furnace 27 and offgas treatment equipment 29, the air 53 introduced by the blower 52 was heated, and it uses as a heat source for heating of the dechlorination furnace 17 with the heating gas 54 introduced separately. In addition, the gas after heating at the dechlorination furnace 17 is supplied via Rhine 46 like the gestalt of the 2nd operation as the heat source of a preheater 14, and a heat source of a drying furnace 41. Moreover, the gas after heating at the dechlorination furnace 17 is supplied via Rhine 55 and 56 as the heat source of a preheater 14, and a heat source of a drying furnace 41. In addition, offgas treatment of the exhaust gas 48 in a drying furnace 41 is carried out separately.

[0074] the dechlorination fuel 42 after dechlorination (pyrolysis) is led to the next gasification, oil-izing, or a combustion process by the above approach -- having -- the organic substance (hydrocarbon) -- gasification and oil-izing -- or combustion processing is carried out. Since it is dechlorinated in the case of this combustion, the occurring gas is harmless, and in order that a chloride may not carry out little deer survival into residue, pollution-free-ization of residue becomes easy. Moreover, by installation of a heat exchanger 43, while being able to use exhaust heat effectively, a steam is generated with the obtained heat, this steam can be used at the dechlorination furnace 17, and a deployment of heat is attained.

[0075] With the gestalt of [gestalt of the 4th operation] book operation, like the gestalt of the 3rd operation, after carrying out the pyrolysis dechlorination of the trash containing chlorine, it once rinses. Although use of exhaust heat at a secondary combustion furnace is aimed at while obtaining the solid fuel which was made to dry further what was made to dissolve the mineral salt ghost which carried out the byproduction in water, and was separated with a drying furnace, and was dechlorinated It is mere trash to RDF (Rdfuse Derived Fuel: dust solidification fuel) about the object to process. It differs in that it used.